We claim:

1. A monocyclopentadienyl complex comprising the structural feature of the formula $Cp\text{-}Y_mM^A$ (I), where the variables have the following meanings:

Cp is a cyclopentadienyl system having an aryl substituent,

Y is a substituent which is bound to Cp and contains at least one uncharged donor containing at least one atom of group 15 or 16 of the Periodic Table,

M^A is titanium, zirconium, hafnium, vanadium, niobium, tantalum, chromium, molybdenum or tungsten or an element of group 3 of the Periodic Table and the lanthanides and

m is 1, 2 or 3.

2. A monocyclopentadienyl complex as claimed in claim 1 having the formula $Cp\text{-}Y_mM^AX^A_n$ (V), where the variables have the following meanings:

Cp is a cyclopentadienyl system having an aryl substituent,

Y is a substituent which is bound to Cp and contains at least one uncharged donor containing at least one atom of group 15 or 16 of the Periodic Table,

M^A is titanium, zirconium, hafnium, vanadium, niobium, tantalum, chromium, molybdenum or tungsten or an element of group 3 of the Periodic Table and the lanthanides and

m is 1, 2 or 3,

X^A the radicals X^A are each, independently of one another, fluorine, chlorine, bromine, iodine, hydrogen, C_1-C_{10}-alkyl, C_2-C_{10}-alkenyl, C_6-C_{20}-aryl, alkylaryl having 1-10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part, $NR^{23A}R^{24A}$, OR^{23A}, SR^{23A}, SO_3R^{23A}, $OC(O)R^{23A}$, CN, SCN, β-diketonate, CO, BF_4^-, PF_6^- or bulky noncoordinating anions or two radicals X^A form a substituted or unsubstituted diene ligand, in particular a 1,3-diene ligand, and the radicals X^A may be joined to one another,

R^{23A}-R^{24A} are each, independently of one another, hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part, SiR^{25A}_3, where the organic radicals R^{23A}-R^{24A} may also

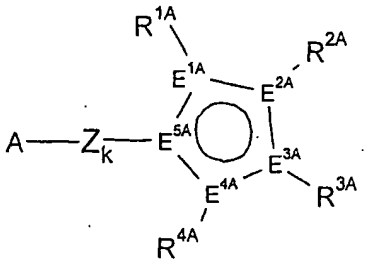
be substituted by halogens or nitrogen- and oxygen-containing groups and two radicals R^{23A}-R^{24A} may also be joined to form a five- or six-membered ring,

R^{25A} the radicals R^{25A} are each, independently of one another, hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part and two radicals R^{25A} may also be joined to form a five- or six-membered ring and

n is 1, 2, or 3.

3. A monocyclopentadienyl complex as claimed in claim 1 or 2 in which Y is formed by the group $-Z_k$-A- and together with the cyclopentadienyl system Cp and M^A forms a monocyclopentadienyl complex comprising the structural element of the formula Cp–Z_k-A-M^A (II), where the variables have the following meanings:

Cp–Z_k-A



(III)

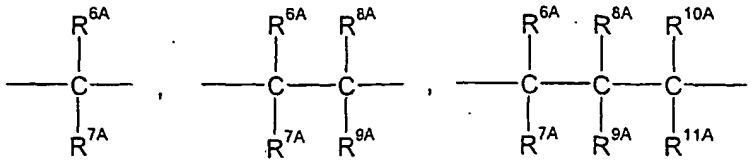
Where the variables have the following meanings:

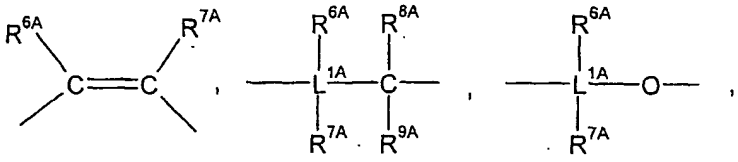
E^{1A}-E^{5A} are each carbon or not more than one E^{1A} to E^{5A} is phosphorus,

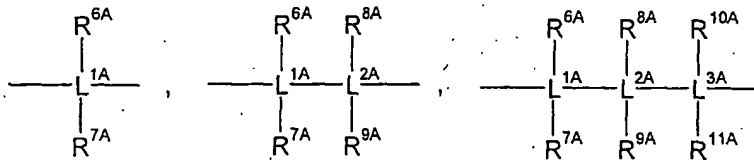
R^{1A}-R^{4A} are each, independently of one another, hydrogen, C_1-C_{22}-alkyl, C_2-C_{22}-alkenyl, C_6-C_{22}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl radical and 6-20 carbon atoms in the aryl radical, NR^{5A}_2, $N(SiR^{5A}_3)_2$, OR^{5A}, $OSiR^{5A}_3$, SiR^{5A}_3, BR^{5A}_2, where the organic radicals R^{1A}-R^{4A} may also be substituted by halogens and two vicinal radicals R^{1A}-R^{4A} may also be joined to form a five-, six- or seven-membered ring, and/or two vicinal radicals R^{1A}-R^{4A} are joined to form a five-, six- or seven-membered heterocycle which contains at least one atom from the group consisting of N, P,O or S and at least one R^{1A}-R^{4A} is a C_6-C_{22}-aryl, where the aryl may also be substituted by N-, P-, O- or S-containing substituents, C_1-C_{22}-alkyl, C_2-C_{22}-alkenyl, halogens or haloalkyls or haloaryls having 1 –10 carbon atoms,

R^{5A} the radicals R^{5A} are each, independently of one another, hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part and two geminal radicals R^{5A} may also be joined to form a five- or six-membered ring,

Z is a divalent bridge between A and Cp selected from the group consisting of







$-BR^{6A}-$, $-BNR^{6A}R^{7A}-$, $-AlR^{6A}-$, $-Sn-$, $-O-$, $-S-$, $-SO-$, $-SO_2-$, $-NR^{6A}-$, $-CO-$, $-PR^{6A}-$ or $-P(O)R^{6A}$,

where

L^{1A}-L^{3A} are each, independently of one another, silicon or germanium,

R^{6A}-R^{11A} are each, independently of one another, hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{12A}_3, where the organic radicals R^{6A}-R^{11A} may also be substituted by halogens and two geminal or vicinal radicals R^{6A}-R^{11A} may also be joined to form a five- or six-membered ring and

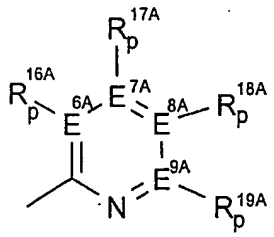
R^{12A} the radicals R^{12A} are each, independently of one another, hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl or alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part, C_1–C_{10}–alkoxy or C_6–C_{10}–aryloxy and two radicals R^{12A} may also be joined to form a five- or six-membered ring, and

A is an uncharged donor group containing one or more atoms of group 15 and/or 16 of the Periodic Table of the Elements or a carbene, preferably an unsubstituted, substituted or fused, heteroaromatic ring system,

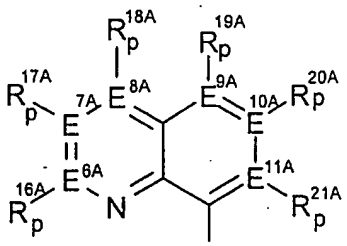
M^A is a metal selected from the group consisting of titanium in the oxidation state 3, vanadium, chromium, molybdenum and tungsten and

k is 0 or 1.

4. A monocyclopentadienyl complex as claimed in any of claims 1 to 3 in which A is a group of the formula (IVa) or (IVb):



(IVa)



(IVb)

, where

E^{6A}-E^{11A} are each, independently of one another, carbon or nitrogen,

R^{16A}-R^{21A} are each, independently of one another, hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{22A}_3, where the organic radicals R^{16A}-R^{21A} may also be substituted by halogens or nitrogen and further C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{22A}_3 groups and two vicinal radicals R^{16A}-R^{21A} or R^{16A} and Z may also be joined to form a five- or six-membered ring and

R^{22A} the radicals R^{22A} are each, independently of one another, hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl or alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part and two radicals R^{22A} may also be joined to form a five- or six-membered ring and

p is 0 when E^{6A}-E^{11A} is nitrogen and is 1 when E^{6A}-E^{11A} is carbon.

5. A monocyclopentadienyl complex as claimed in claim 3 or 4 in which –Z-A and the aryl substituent are in the 1,3-positions relative to one another.

6. A catalyst system for olefin polymerization comprising

A) at least one monocyclopentadienyl complex according to claims 1 to 5,

B) optionally an organic or inorganic support,

C) optionally one or more activating compounds,

D) optionally further catalysts suitable for olefin polymerization and

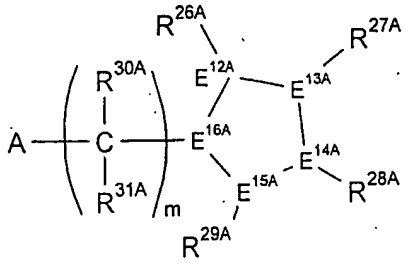
E) optionally one or more metal compounds containing a metal of group 1, 2 or 13 of the Periodic Table.

7. A prepolymerized catalyst system comprising a catalyst system as claimed in claim 6 and one or more linear C_2-C_{10}-1-alkenes polymerized onto it in a mass ratio of from 1:0.1 to 1:1 000 based on the catalyst system.

8. The use of a catalyst system as claimed in claim 6 or 7 for the polymerization or copolymerization of olefins.

9. A process for preparing polyolefins by polymerization or copolymerization of olefins in the presence of a catalyst system as claimed in claim 6 or 7.

10. A process for preparing cyclopentadiene systems of the formula (VIa),



(VIa)

where the variables have the following meanings:

E^{12A}-E^{16A} are each carbon, with four adjacent E^{12A}-E^{16A} forming a conjugated diene system and the remaining E^{12A}-E^{16A} additionally bearing a hydrogen,

R^{26A}-R^{29A} are each, independently of one another, hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part, NR^{32A}_2, $N(SiR^{32A}_3)_2$, OR^{32A}, $OSiR^{32A}_3$, BR^{32A}_2, SiR^{32A}_3, where the organic radicals R^{26A}-R^{29A} may also be substituted by halogens and two vicinal radicals R^{26A}-R^{29A} may also be joined to form a five- or six-membered ring, and/or two vicinal radicals R^{26A}-R^{29A} are joined to form a heterocycle which contains at least one atom from the group consisting of N, P, O or S,

R^{30A}-R^{31A} are each, independently of one another, hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{32A}_3, where the organic radicals R^{30A}-R^{31A} may also be substituted by halogens and R^{30A} or R^{31A} and A may also be joined to form a five- or six-membered ring,

R^{32A} the radicals R^{32A} are each, independently of one another, hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part and two geminal radicals R^{32A} may also be joined to form a five- or six-membered ring,

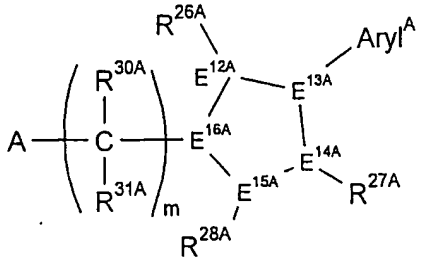
m is 0, 1 or 2,

A is an uncharged donor group containing one or more atoms of group 15 and/or 16 of the Periodic Table of the Elements or a carbene, preferably an unsubstituted, substituted or fused, heteroaromatic ring system,

which comprises:

a) reacting an $(A\text{-}(CR^{29A}R^{30A})_m)^-$- anion with a cyclopentanedione or a silyl ether of an enolised cyclopentanedione.

11. A process for preparing cyclopentadiene systems of the formula (VIb),



(VIb)

where the variables have the following meanings:

E^{12A}-E^{16A} are each carbon, with four adjacent E^{12A}-E^{16A} forming a conjugated diene system and the remaining E^{12A}-E^{16A} additionally bearing a hydrogen,

R^{26A}-R^{28A} are each, independently of one another, hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part, SiR^{32A}_3, where the organic radicals R^{26A}-R^{28A} may also be substituted by halogens and two vicinal radicals R^{27A}-R^{28A} may also be joined to form a five- or six-membered ring, and/or two vicinal radicals R^{27A}-R^{28A} are joined to form a heterocycle which contains at least one atom from the group consisting of N, P, O or S,

R^{30A}-R^{31A} are each, independently of one another, hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{32A}_3, where the organic radicals R^{30A}-R^{31A} may also be substituted by halogens and R^{30A} or R^{31A} and A may also be joined to form a five- or six-membered ring,

R^{32A} the radicals R^{32A} are each, independently of one another, hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part and two geminal radicals R^{32A} may also be joined to form a five- or six-membered ring,

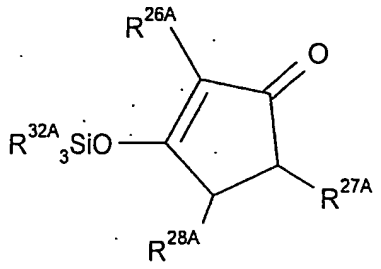
$Aryl^A$ is C_6-C_{22}-aryl, for example phenyl, naphthyl, biphenyl, anthracenyl or phenanthrenyl, which may also be substituted by N-, P-, O- or S-containing substituents, C_1-C_{22}-alkyl, C_2-C_{22}-alkenyl, halogens or haloalkyls or haloaryls having 1–10 carbon atoms and

m is 0 or 1,

A is an unsubstituted, substituted or fused heteroaromatic ring system,

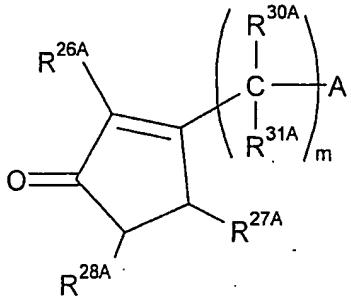
which comprises:

a) reacting an $(A\text{-}(CR^{30A}R^{31A})_m)^-$- anion with a cyclopentenone system of the formula (VII)



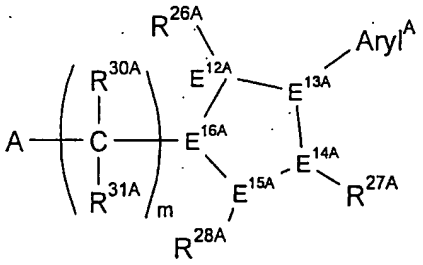
(VII)

to form a cyclopentenone of the formula (VIII)



(VIII)

12. A cyclopentadiene system of the formula (VIb),



(VIb)

where the variables have the following meanings:

E^{12A}-E^{16A} are each carbon, with four adjacent E^{12A}-E^{16A} forming a conjugated diene system and the remaining E^{12A}-E^{16A} additionally bearing a hydrogen,

R^{26A}-R^{28A} are each, independently of one another, hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part, SiR^{32A}_3, where the organic radicals R^{26A}-R^{28A} may also be substituted by halogens and two vicinal radicals R^{27A}-R^{28A} may also be joined to form a five- or six-membered ring, and/or two vicinal radicals R^{27A}-R^{28A} are joined to form a heterocycle which contains at least one atom from the group consisting of N, P, O or S,

R^{30A}-R^{31A} are each, independently of one another, hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{32A}_3, where the organic radicals R^{30A}-R^{31A} may also be substituted by halogens and R^{30A} or R^{31A} and A may also be joined to form a five- or six-membered ring,

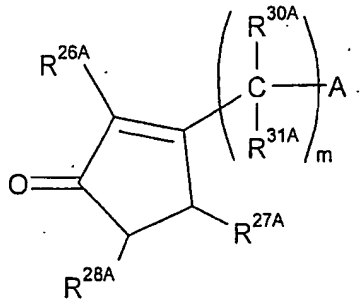
R^{32A} the radicals R^{32A} are each, independently of one another, hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part and two geminal radicals R^{32A} may also be joined to form a five- or six-membered ring,

$Aryl^A$ is C_6-C_{22}-aryl, for example phenyl, naphthyl, biphenyl, anthracenyl or phenanthrenyl, which may also be substituted by N-, P-, O- or S-containing substituents, C_1-C_{22}-alkyl, C_2-C_{22}-alkenyl, halogens or haloalkyls or haloaryls having 1–10 carbon atoms and

m is 0 or 1 and

A is an unsubstituted, substituted or fused heteroaromatic ring system.

13. A cyclopentenone of the formula (VIII)



(VIII)

where the variables have the following meanings:

R^{26A}-R^{28A} are each, independently of one another, hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part, SiR^{32A}_3, where the organic radicals R^{26A}-R^{28A} may also be substituted by halogens and two vicinal radicals R^{27A}-R^{28A} may also be joined to form a five- or six-membered ring, and/or two vicinal radicals R^{27A}-R^{28A} are joined to form a heterocycle which contains at least one atom from the group consisting of N, P, O or S,

R^{30A}-R^{31A} are each, independently of one another, hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{32A}_3, where the organic radicals R^{30A}-R^{31A} may also be substituted by halogens and R^{30A} or R^{31A} and A may also be joined to form a five- or six-membered ring,

R^{32A} the radicals R^{32A} are each, independently of one another, hydrogen, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl, C_6-C_{20}-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part and two geminal radicals R^{32A} may also be joined to form a five- or six-membered ring,

$Aryl^A$ is C_6-C_{22}-aryl, for example phenyl, naphthyl, biphenyl, anthracenyl or phenanthrenyl, which may also be substituted by N-, P-, O- or S-containing substituents, C_1-C_{22}-alkyl, C_2-C_{22}-alkenyl, halogens or haloalkyls or haloaryls having 1–10 carbon atoms and

m is 0 or 1 and

A is an unsubstituted, substituted or fused heteroaromatic ring system.